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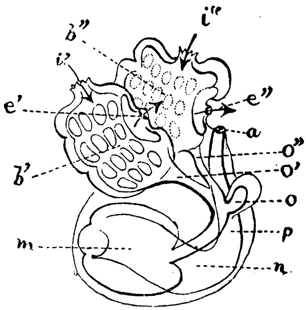
ZOOLOGY.

Temperature and Color in Lepidoptera.—At the meeting, March 24, 1892, of the South London Entomological and Natural History Society, Mr. F. Merrifield exhibited examples of *Selenia illustraria, S. illunaria, S. lunaria, Vanessa urticœ, Platypteryx falcataria, Chelonia caia, Bombyx quercus* and var. *callunœ,* to illustrate the effects of temperature on these species. He prefaced his remarks by referring to the experiments of Weismann and Edwards which were made on seasonally dimorphic species, and said that his results were consistent with those of these gentlemen; but he went further than they did, and he found that by subjecting the pupæ to certain temperatures he invariably, in the majority of specimens, obtained certain results, a lower temperature generally producing darker and more intense colors than higher temperatures. In *illustraria,* a brood divided into two portions, and one placed at a temperature of about 80°, produced normal specimens, while the other portion, placed at 50° or 60° were strikingly darker in color. The same results, but in less degree, were obtained with other forms. In *V. urticœ* some of the examples closely approached var. *polaris,* the specimens exposed to the lower temperature being generally darker and the blue crescents more intense in color. In conclusion Mr. Merrifield said that a temperature of 47° seemed to stunt the size and produced a large proportion of cripples, and higher temperatures than this seemed more conducive to health and vigor. It had been suggested that the results he obtained were attributed to the unhealthy conditions to which the pupæ were exposed, but this was not at all a correct explanation; in the 172 specmens he exhibited 150 were not cripples. Extreme temperatures produced crippling, but moderate temperatures were quite sufficient to account for the extreme difference in coloring. Mr. Fenn said he had since 1859 paid great attention to the earlier stages of Lepidoptera, and he assumed that variation was either natural or artificial. Natural variation might again be divided into three nearly equal causes: heredity, moisture and natural selection. In artificial selection the causes might generally be said to be abnormal or diseased. By disease he meant a general weakening of the constitution by unnatural influences; the least deviation from natural conditions might produce variation. Mr. Fenn had had considerable experience in breeding *E. autumnaria,* one of the species relied on, and in the series he exhibited there were many paler and many darker than any shown by Mr. Merrifield; and the larvæ and pupæ had been kept under usual conditions, and the greater proportion of them followed the parent forms. In conclusion he said that such variation as was shown by Mr. Merrifield was impossible in nature except as a result of disease. Several gentlemen continued the discussion, Mr. Tutt following Mr. Fenn in attributing the variation to disease, and saying that to a large extent it was caused by preventing the proper development and formation of the coloring pigment. He thought the action of temperature indirect, producing variation by interfering with the normal development. Mr. Merrifield agreed with many of Mr. Fenn's observations and thought most of them consistent with his own experiments. In any case he thought that in the species studied by him the temperature was so moderate as not to interfere with health, and yet it produced, with great uniformity, considerable differences in color. In some other species no considerable changes were produced unless the temperature was so extreme as to produce crippling or imperfect development.—(Entom. Monthly Magazine.)

A Curious Compound Ascidian.—In a current number of a Japanese zoological journal,[1] Mr. A. Oka, now of Freiburg, i | Br., Germany, describes an interesting phenomenon in the life of a compound Ascidian, *Diplosoma,* which he collected some years ago at Misaki, Japan. As an examination of the accompanying diagram will show, the œsophagus of each individual Ascidian is divided into two branches (o′ and o″), each branch terminating in one branchial basket (b′ and b″) respectively. The branchial basket indicated by the dotted line (b″) is old, while the other basket (b′) is young and functional. On the other side of the œsophagus is represented a young bud (o) which, when fully unfolded, becomes a functional branchial apparatus, and takes the place of (b′); the oldest basket (b″) having disappeared by that time. Various intermediate stages indicating this state of transition have been observed. In such forms the œsophageal end of the alimentary canal shows division into three branches. The



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[1] *The Zoological Magazine* (Japanese), vol. iv, no. 42, pp. 144–146, April 15, 1892. Tokio, Japan.

anus (a) opens in *Diplosoma*, as in *Appendicularia*, independently by itself; hence, the anus does not share with the branchial basket the phenomenon of occasional regeneration, but persists throughout life. In one individual, then, such as is shown in the accompanying diagram, there exist five openings, *viz.*, the old incurrent pore (i″), the old excurrent pore (e″), the young incurrent pore (i′), the young excurrent pore (e′) and the permanent anus (a).

This regeneration of a complete organ, not as a result of artificial mutilation of the organism, nor as the result of the removal of any part, but as a result of a normal physiological process is very remarkable. Mr. Oka thinks it similar to certain phenomena common in the vegetable kingdom.—(Translated and abstracted by Dr. Watase, Clark University.)

The Development of the Teeth of Man.—Dr. Carl Röse has studied the development of human teeth and comes to the following conclusions.[1] The first trace of the primary dental ridge appears simultaneously (34–40 days) in both jaws. It is in section a semicircular ingrowth of not yet differentiated cells of the epithelium of the jaw. It appears at the same time with Meckel's cartilage. At about 48 days (17 mm) the primary dental ridge splits into two ridges lying at right angles to each other. Of these the one going vertically into the jaw is the labial groove ridge, the other, going horizontally into the jaw, is the true dental ridge. The deepest layer of the epithelium is of high cylindrical cells. The labial groove ridge continues to grow deeper while its upper layer becomes resorbed, thus giving rise to the furrow between the lip and the jaw, the process beginning at the middle and extending each way. The slight dental groove which runs along the line of the union of jaw epithelium and dental ridge is at first on the outer surface of the jaw and gradually wanders in a spiral line over the jaw to the posterior surface, the middle advancing more rapidly than the sides.

The dental ridge which at first was horizontal changes its position as a result of the growth of the milk teeth, and becomes more and more vertical. Its free edges become produced into undulatory outgrowths, ten in number, which become spherical and form the first anlagen of the milk dentition. At the tenth week (embryo of 32 mm length) there begins simultaneously, or in quick succession, the pushing in of the papillæ into these outgrowths, *and these connective tissue*

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[1] Arch. f. mikr. Anat. xxxviii, 447, 1891.

papillæ do not push into the deepest but into the lateral portion. In this way the dental ridge can continue its growth behind the milk-teeth unhindered by the process of separation of these teeth, which begins in the fourteenth week. At the same time the ridge shows irregular outgrowths and three weeks later these have become more evident, and in the region of the incisors a partial fenestration of the ridge is begun.

At the twenty-fourth week the dental ridge, in the region of the anterior teeth, has become converted into a sieve-like plate with irregular projections; in the molar region it is as yet smooth and unbroken and its under margin retains the thickened and undulating character. In front of and mesial to these thickenings are the milk teeth, and from the side of these milk teeth the papillæ of the permanent teeth (the incisors first) encroach upon the thickened margins of the dental ridge. The dental ridge grows behind the second milk molar in the fourteenth week and at the seventeenth its end is thickened, and from this thickening is developed the first permanent molar.

At the time of birth the ridge extends behind the first molar as a short thickened plate which at the sixth month has extended farther backward and has become thickened for the second molar which is formed as before. In the child of three and a quarter years the condition behind the second molar is like that in the child at birth, behind the first molar. The wisdom tooth arises about the fifth year by a lateral ingrowth like that of the other molars. Owing to the extraordinary adaptability of the dental ridge there is a possibility of a fourth molar behind the wisdom tooth and also of a third dentition in the anterior portion of the jaws.

Odontogenesis in the Ungulates.—Julius Laecker, of the Veterinär Institut of Dorpat, has just completed a most interesting series of studies upon Odontogenesis in the Ungulates. He undertook their investigation with the purpose of determining how far the embryological development of the crowns of the molar teeth repeats the palæontological development, and especially to test the theory of bunodont origin advocated by Cope and Gaudry as opposed to the earlier Rütimeyer-Kowalevsky hypothesis that the primitive molars of ungulates were crested or lophodont. His method of research was an improvement of that introduced by Klever[1] upon the molars of the horse but his material included not only embryos of the horse, but of the pig as a modern bunodont, and as selenodont types a number of elk (*Alces palmatus*) embryos, one stage of the deer (*Capreolus capræa*), abundant material of the ox and sheep as hypselenodont types, and of even greater interest, an embryo of one of the rare and transitional ancient group of Tragulidæ. As, in course of his investigation, he found abundant evidence in support of the remote tritubercular origin of these modern highly modified teeth, he adopts Cope's theory and Osborn's nomenclature and homologies, so that the reader can readily compare his plates and descriptions with the palæontological series as recently figured by Cope, Scott, Lydekker, Schlosser and others.

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[1] "Zur Kenntniss der Morphogenese d. Equidengebisses," Morph. Jahrb. xv, p. 308, 1889.

We may now quote his conclusions: "As a result of my investigations it is evident that both the bunodont Suidæ, and selenodont ruminants present a closely similar initial bunodont stage; according to which the Cope–Osborn opinions are in general conformed by embryological data, although in many points, especially as regards the (more elevated position of the) protocone, ontogenesis is no longer parallel with phylogenesis.

2. The differentiation soon follows whereby the separate cones and conids in the pig transform into pyramids and in the ruminants into crescents.

3. The transformation of the cones affects the separate cones in succession, not beginning with the protocone but with the earlier developed paracone. [The author has unconsciously strengthened his proof here, for it is well known that in the fossil series, the external upper cusps, i. e., the paracone and metacone, assume the selenoid form earlier and more universally than the protocone.]

4. In the last two upper deciduous premolars (D^4 D^3) from an originally conic metacone is developed a tooth with two cones, by the addition of the paracone; then, in D^4 at least, appears the protocone and finally the hypocone. In D^3 the protocone is the last cusp added. [Here again the author demonstrates an approximate parallelism between the ontogenesis and phylogenesis; he is evidently not aware of the observation of Schlosser that the upper premolar cusps do not appear in the same order and are therefore not homologous with the molar cusps. The actual order of evolution of the premolar cusps was observed by Osborn[1] in *Hyracotherium* as follows: A cusp *analogous* with the paracone (really the protocone) first appears, then the outer cusp divides into two, paracone and metacone,

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[1] MSS. of chapter upon the *Equidæ* for the "American Fossil Mammals."

or more commonly the protocone appears second, and the metacone third, then the protoconule appears, the hypocone, followed finally by the metaconule. Similarly the lower premolars do not repeat the ancestral lower molar history, the order is protoconid, hypoconid, metaconid, entoconid. "Scott[1] has worked this out in the Artiodactyla as follows: *4th. upper premolar*—paracone (protocone), protocone deuterocone), metacone (tritocone), hypocone (tetartocone). *4th. lower premolar*—protoconid, metaconid (deuteroconid), hypoconid, entoconid.] Turning again to Laeker's investigation we find that:

5. In the lower jaw the fourth milk molar the order is protoconid, ? paraconid, (anterior cusp) hypoconid, metaconid, entoconid. [The homology of the paraconid is somewhat uncertain.]

In considering the exceptions between ontogenesis and phylogenesis here noted, we must remember the extreme antiquity of some of these structures, dating back to the middle and lower Eocene, for upon the whole the parallelism is most striking.—HENRY F. OSBORN, American Museum of Natural History, New York, May 23rd, 1892.

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[1] "Osteology of *Poëbrotherium*," Journ. of Morphology, June 1891, pp. 48–49.